

Appln. No. 10/562,602
Reply to Office Action dated May 9, 2007
Response A, dated July 18, 2007

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REMARKS/ARGUMENTS

A. Concerning the Amendments to the Claims

Claims 1 and 19 are amended to replace the term "about 8.3" with the term "8.3."

Claim 13 has been re-written in independent form including all of the limitations of Claim 1 from which Claim 13 depended.

Claims 1, 4, 5, 7, 8, 11, 12, 13, 15, 16, 19-23, 25-28, 30, 33, and 34 remain pending in the application as shown in the listing of claims herein.

Claims 2, 3, 6, 9, 10, 14, 17, 18, 24, 29, 31, and 32, not shown in the listing of claims herein, were previously canceled in Applicants' Preliminary Amendment, dated December 28, 2005.

Applicants estimate that no fee is required for the above amendments. If this estimate is incorrect, the Examiner is authorized to charge Deposit Account 210100 the required fee.

B. Concerning the Rejection of Claims 1, 8, 11, 12, and 15 Under 35 U.S.C. 102(b) Over Packett, et al.

Claims 1, 8, 11, 12, and 15 stand rejected under 35 U.S.C. 102(b) as allegedly being anticipated by *Packett et al.* (US 5,886,237). The Office Action argues that although "*Packett et al.* do not expressly disclose a method of minimizing the production of phosphonium ion degradation products, as per the instant claims; however, since all of the reaction parameters of the instant claims are disclosed by *Packett et al.*, the reaction disclosed by *Packett et al.* must inherently minimize the production of these degradation products." This rejection is traversed for the following reasons.

Claim 1 involves a method of minimizing the production of one or more phosphonium ion ligand degradation products in a reaction process, e.g., hydroformylation, wherein a polyunsaturated olefin, e.g., butadiene, is reacted in the presence of a transition metal-triorganophosphine ligand complex catalyst to form as a product, by-product, or intermediate product a conjugated functionalized olefin comprising an α,β -unsaturated aldehyde, for example, 2-pentenal. The minimization method comprises conducting the reaction process with a triorganophosphine ligand having a ligand cone angle greater than 135° or a pKa of less than 8.3.

Packett et al. generally discloses hydroformylation processes wherein a polyunsaturated olefin, e.g., butadiene, is reacted with carbon monoxide and hydrogen in the presence of transition metal-organophosphorus ligand complex catalyst to form a conjugated unsaturated aldehyde, e.g., 2-pentenal. Significantly, *Packett et al.* is silent with regard to ligand cone angle, ligand pKa, phosphonium ion ligand degradation products and minimization thereof, all of which parameters and effects are key features of Claims 1, 8, 11,

Appln. No. 10/562,602
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12, and 15. Silence in a reference is never a proper substitution for facts. Each and every element of the claims must be disclosed expressly or implicitly for anticipation.

Fully 25 columns of *Packett et al.* are set aside for description of organophosphorus ligands including a wide variety of triorganophosphine, organomonophosphite, and organopolyphosphite ligands of numerous species and structures. (Columns 4-28) Significantly, organomonophosphite and organopolyphosphite ligands are incapable of reacting with conjugated α,β -unsaturated aldehydes to form stable phosphonium ion ligand degradation products. Thus, for the disclosed organophosphite ligands the problem taken up by the present invention is completely irrelevant. Only triorganophosphine ligands are relevant to forming stable phosphonium ion ligand degradation products, which lie at the heart of the present invention.

The working examples in *Packett et al.* further illustrate the broad and unselective scope of its description. The illustrated ligands are split nearly equally between organophosphite and triorganophosphine ligands. None of Examples 1-9 and 16-17 illustrating organophosphite ligands, which do not form phosphonium ion ligand degradation products, are relevant. Among the illustrated triorganophosphine ligands, some working examples (Examples 10-15, 18-22) may meet the pKa and cone angle criteria of the present claims; however more significantly, other working examples (Examples 23-31) illustrate a mixture of triorganophosphine ligands wherein one ligand meets the criteria (tris(2-cyanoethyl)phosphine) while the other does not (triethylphosphine). Ligands meeting the criteria of the claimed invention are nowhere identified by *Packett et al.* as being special. Thus, what might be inherently present in one example is completely absent in the next example.

Since *Packett et al.* teaches in many different directions, first "this way" and then "that way," *Packett et al.* cannot support a rejection based upon inherency. Anticipation by inherency involves a matter of fact meaning that the hypothetical skilled person would necessarily and inevitably arrive at the invention, that is, the claimed invention is constructively placed in the possession of the public by the reference. Such is not the case with *Packett et al.* where the skilled person would have to pick and choose some, but not all of the characteristics of *Packett et al.* to arrive at the invention. In picking and choosing, the invention cannot and does not necessarily and certainly flow from the reference. *Ex parte Gavin*, 62 USPQ2d 1680 (BPAI 2001); *Ex parte Levy*, 17 USPQ2d 1461 (BPAI 1990).

More to the point, *Packett et al.* nowhere recognizes the problem associated with consumption of triorganophosphine ligands through formation of detrimental phosphonium ion ligand degradation products. Thus, the present claims constitute a patentable selection of elements or characteristics for a clearly defined purpose, i.e., minimization of phosphonium ion ligand degradation products, all aspects of which are neither disclosed expressly nor implicitly by *Packett et al.* In view of the above, it is submitted that Claims 1,

Appl. No. 10/562,602
Reply to Office Action dated May 9, 2007
Response A, dated July 18, 2007

8, 11, 12, and 15 meet the standards for novelty. It is respectfully requested that the rejection be withdrawn.

C. Concerning the Rejection of Claims 4, 5, 16, 19-21 Under 35 U.S.C. 103(a) Over Packett, et al.

Claims 4, 5, 16, 19-21 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over *Packett et al.* The Office Action takes the position that "it would have been obvious to a person having ordinary skill in the art, at the time the present invention was made, to modify process conditions such as temperature and/or pressure, in order to control the level of conversion of the polyolefin and/or selectivity to the desired alkenal." This rejection is traversed for the following reasons.

In addition to the selected cone angle and/or pKa of the triorganophosphine ligand, Claim 4 requires a conversion of greater than about 80 and less than about 95 weight percent of the polyunsaturated olefin, and Claim 5 requires a temperature greater than about 45°C and less than about 95°C and a pressure greater than about 300 psig and less than about 5,000 psig. Claims 16 and 20-21 also rely on the specific temperature and pressure ranges.

Packett et al. discloses an exceptionally broad range of process temperatures from -25°C to 200°C, process pressures from 1 to 10,000 psia, and conversions from 1 to 99 weight percent. The more preferred hydroformylation conditions disclose a temperature from 65°C to 115°C, a pressure from 75 psig to 1,000 psig, and conversion from 1 to 50 weight percent, these narrow ranges still being distinctly different from the claimed ranges. Likewise, *Packett's* working examples illustrate temperatures and conversions both inside and outside the scope of the claims. While there is some overlap with the claimed ranges, *Packett et al.* provides no markers, indicators, or guidance whatsoever for the specific selections made by the Applicants.

True, the skilled person may know how to manipulate process conditions. That fact alone does not create an obviousness problem for the present claims, because the present claims solve a problem not even remotely recognized or hinted at in *Packett et al.*, i.e., to minimize the formation of phosphonium ion ligand degradation products formed via detrimental reactions of triorganophosphine ligands with α,β -unsaturated aldehyde products. Without a solution to the problem, the process chokes on increasing quantities of undesirable ligand degradation products, while requiring a constant supply of fresh and expensive triorganophosphine ligand.

Not only is *Packett et al.* blind to the problem, they make no suggestion whatsoever of a solution to the problem. *Packett et al.* fails to recognize that correlations exist between phosphonium ion ligand degradation products and conversion of polyunsaturated olefin, temperature, and pressure, let alone what directions these correlations may take. Such correlations can only be seen in hindsight looking from the present invention and Applicants' working examples at pages 34-39 of the specification, which perspective is not permissible.

Appln. No. 10/562,602
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It is not clear how the skilled person would arrive at the invention from *Packett et al.*, since *Packett et al.* says nothing concerning the underlying problem of phosphonium ion ligand degradation products and nothing directed towards the claimed selections of ligand cone angle, ligand pKa, olefin conversion, temperature, and pressure that minimize the problem. Accordingly, the claims meet the statutory requirements for unobviousness over *Packett et al.* It is respectfully requested that the rejection under 103(a) be withdrawn.

D. Concerning the Rejection of Claims 1, 4, 5, 7, 8, 11, 12, 15, 16 Under 35 U.S.C. 103(a) Over Guram, et al.

Claims 1, 4, 5, 7, 8, 11, 12, 15, 16 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over *Guram, et al.* (US 6,034,286). The Office Action takes the position that "although *Guram, et al.* does not teach a method of minimizing the production of phosphonium ion degradation products, as per the instant claims; however, since all of the reaction parameters of the instant claims are disclosed in *Guram, et al.*, the reaction taught by *Guram, et al.* must inherently minimize the production of these degradation products." This rejection is traversed for the following reasons.

At the start, it seems improper for an inherency argument to be made under section 103(a). Inherency is a matter of fact and certainty, and therefore, a matter of anticipation (102(b)). Inasmuch as the Examiner acknowledges a difference between *Guram et al.* as being drawn to production of alcohols and the claims as being drawn to production of unsaturated aldehydes, the claims cannot be anticipated by *Guram et al.* On these grounds alone, inherency anticipation is not applicable and the rejection should be removed.

More to the point, the present invention concerns itself with the minimization of phosphonium ion ligand degradation products that consume useful triorganophosphine ligands. There is no description whatsoever in *Guram et al.* that leads the skilled person to this problem. In fact, the skilled person is led away from such considerations by *Guram's* focus on preparing saturated alcohols that cannot react with triorganophosphine ligands to form detrimental phosphonium ion ligand degradation products as do α,β -unsaturated aldehydes.

Moreover, the ligands disclosed by *Guram et al.* vary over many diverse classes of organophosphines, including ligands with basicities from about 2.74 to about 15, i.e. far beyond the range of less than 8.3 of the criteria of the claimed process. For example, of the illustrative ligands disclosed in *Guram et al.* that are shown in Table 1 for which the basicity data are provided, nine of the sixteen ligands lie outside the range of the current invention of less than 8.3. Moreover, *Guram et al.* teaches the preferred organophosphine ligand as having a low steric bulk, which points in the very opposite direction of the claimed process, wherein the organophosphine ligand must have a cone angle greater than 135°. Larger cone angle correlates with greater steric bulk.

The working examples set forth in *Guram et al.* employ primarily trioctylphosphine, which has a cone angle of only 132° and a pKa of 8.3. Accordingly, trioctylphosphine lies outside the criteria selected for the present

CENTRAL FAX CENTER

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invention. Example 4B of Applicants' specification illustrates the undesirable effects of using trioctylphosphine as a ligand in producing 17.9 weight percent phosphonium ion ligand degradation products. In contrast, Examples 4C and 4D of the specification employ cyclohexyl-di-n-butylphosphine and tri-isobutylphosphine, respectively, which fall within the claimed criteria of cone angle and which produce significantly less phosphonium ion ligand degradation products at only 9.8 and 0.3 weight percent, respectively.

Further, *Guram et al.*, at Column 14, lines 34-55 and in all working examples, teaches the use of a promoter that facilitates the formation of 1-pentanols, rather than pentenals. This teaching casts doubt upon the examiners assertion that "it would have been obvious to a person of ordinary skill in the art that unsaturated aldehydes ... are present in the reaction mixture ..." and "[i]f so desired, a person having ordinary skill in the art could have stopped the reaction after the initial conversion of butadiene in order to isolate pentenals ...". But even if the process could have been stopped and pentenals were formed, the initial reaction conditions of 5-10 psi are not optimal for minimizing phosphonium ion degradation products.

It is not clear how the skilled person would arrive at the invention starting from *Guram et al.*, inasmuch as *Guram et al.* refers to saturated alcohols, irrelevant ligands, low steric bulk, and a broad range including not-optimal process conditions, while remaining silent on the specific problem and solution proffered by the present invention. Accordingly, the claims meet the standards for unobviousness. It is requested that the rejection under 103(a) over *Guram et al.* be withdrawn.

E. Conclusions

Applicants gratefully acknowledge the allowability of Claims 22, 23, 25-28, 30, 33 and 34. Amendments and arguments have been submitted herein on behalf of the rejected claims. We note that amended Claim 13 is further removed from the references since it requires a rate of triorganophosphine ligand usage of less than 2 grams per liter reaction fluid per day. The references are totally silent on ligand usage, let alone a specific rate of ligand usage.

In view of the above, Applicants believe that all of the pending claims meet the statutory requirements for patentability. A Notice of Allowance is requested at the Examiner's earliest convenience.

Respectfully submitted,

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Page 13 of 13